

Cancel

68. The optical filter of claim 58, wherein the first and second reflective waveguides have different filter junctions.

69. The optical filter of claim 58, wherein said outer dimension of said waveguide in the transverse direction is greater than the dimension selected from the group consisting of 0.4 mm, 0.5 mm, 0.6 mm, 0.7 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm, 1.6 mm, 1.8 mm, 2.0 mm, 2.1 mm, 2.3 mm, 2.5 mm, 2.7 mm, 2.9 mm, 3.0 mm, 3.3 mm, 3.6 mm, 3.9 mm, 4.0 mm, 4.2 mm, 4.5 mm, 4.7 mm and 5.0 mm.

REMARKS

Claims 1 - 69 are pending in the present application. Claims 1 – 3, 9, 12, 14, 16, 22 – 25, 27, 31, 32, 34, 36, and 37, have been amended. Claims 38 – 69 have been added. No new matter has been added.

1. *✓* Claims 12, 23, 25 and 36 stand objected to for various informalities. These claims have been amended to correct the informalities, and therefore, it is respectfully submitted the claims be allowed.
2. Claims 1-6, 8-9, 11, 22, 28-30, 32, 34 and 36 are rejected under 35 U.S.C. 102(b) as being anticipated by Li (U.S. Patent 5,841,918).

Claims 1 and 32 have been amended to clarify the claim language. Claims 1 and 32 have been amended to include the limitation of “the amplitude profile of the first filter function is different than the amplitude profile of the second filter function, and the first wavelength band and the second wavelength band overlap spectrally.”

However, Li discloses tunable filters that provide filter function that have the same amplitude profile, as shown in Figs. 2a – 2c, whereby the filters are tuned to trim a broadband signal to a specific central wavelength and bandwidth. (see Col. 3, lines 41 – 45) Li does not teach or suggest varying the amplitude profile of one of the filter functions to provide a desired shape of the overall filter function of the optical filter, as claimed by the Applicants.

Similarly, claim 22 has been amended to clarify the claim language. Claim 22 comprises a waveguide that includes two reflective elements disposed therein to provide a pair of respective filter functions. However, Li discloses a plurality of optical filters 14, 16 that apparently have only one transmissive or reflective element, each of which having a corresponding filter function (see Figs. 2a, 2b). Li does not teach or suggest an optical filter having an optical waveguide that includes a first and second reflective element, as claimed by Applicants.

Claims 2-6, 8-9, 11, 28-30, 33, 34 and 36 variously depends on claim 1, 22 and 32 and therefore, claims 2-6, 8-9, 11, 28-30, 33, 34 and 36 are allowable for at least the reasons provide hereinbefore.

Applicants submit that claims 1-6, 8-9, 11, 22, 28-30, 32-34 and 36 are not anticipated by Li and therefore, it is respectfully requested that these claims be reconsidered and allowed.

3. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li U.S. Patent 5,841,918 in view of Kringlebotn et al. U.S. Patent 6,097,487. Claim 7 variously depends on claim 1 and therefore, claim 7 is allowable for at least the reasons provide hereinbefore.

4. Claims 10 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li U.S. Patent 5,841,918 in view of Kewitsch et al. U.S. Patent 6,236,782. Claims 10 and 35 are dependent on claims 1 and 32, respectively, and therefore claims 10 and 35 are allowable for at least the reasons provide hereinbefore.

5. Claims 12 – 18, 23 – 27 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li U.S. Patent 5,841,918 in view of Fernald et al. U.S. Patent 6,229,827.

Claims 12 – 18 and 23 - 27 variously depend on claims 1 and 22, and therefore, claims 12 – 18 and 23 – 27 are allowable for at least the reasons provide hereinbefore.

Claim 37 has been amended to clarify the claim language. Claim 37 has been amended to include the limitation of “the amplitude profile of the first filter function is different than the amplitude profile of the second filter function, and the first wavelength band and the second wavelength band overlap spectrally.” For the same reasons as provided hereinbefore regarding claims 1 and 32, Applicants submit that claim 37 is not obvious and therefore allowable.

6. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li U.S. Patent 5,841,918 in view of Morey et al. U.S. Patent 5,007,705. Claim 19 is dependent on claim 1, and therefore claim 19 is allowable for at least the reasons provide hereinbefore.

7. Claims 20, 21 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li U.S. Patent 5,841,918 in view of Putnam et al. U.S. Patent 6,310,990. Claims 20, 21 and 31 variously depend on claims 1 and 22, and therefore, claims 20, 21 and 31 are allowable for at least the reasons provide hereinbefore.

8. In view of the foregoing, it is respectfully requested that the application be reconsidered and allowed. If the Examiner is not prepared to allow all the claims in view of the discussion herein, Applicants hereby respectfully request a phone interview with the Examiner at the Examiner's earliest convenient. Applicants' counsel can be reached at 203-626-3502 between the hours of 8:00 a.m. and 5:00 p.m., or by E-mail at rcrawford@cidra.com.

9. A petition for a three-month extension of time under 37 CFR 1.136 is submitted herewith. Please charge the fee of **\$920.00** for the extension of time and **\$660.00** for additional claims submitted by amendment to Deposit Account No. 50-260 Order No. CC-0273. Any deficiency or overpayment should be charged or credited to this deposit account.

Respectfully submitted,
MARTIN A. PUTNAM ET AL



Robert D. Crawford
Registration No. 38,119

CiDRA Corporation
50 Barnes Park North
Wallingford, CT 06492
Telephone: (203) 626-3502

Version with markings to show changes made

✓.

An optical filter comprising:

a first optical element including a first reflective element for receiving light and reflecting a first wavelength band of the light centered at a first reflection wavelength, the first reflective element characterized by a first filter function; and

a second optical element, optically connected to the first optical element to receive the reflected first wavelength band of the light, including a second reflective element for reflecting a second wavelength band of the light centered at a second reflection wavelength, the second reflective element characterized by a second filter function; ~~being different than~~

whereby the amplitude profile of the first filter function; is different than the amplitude profile of the second filter function, and whereby the first reflection-wavelength band and the second reflection-wavelength band overlap spectrally, are aligned to reflect a portion of the aligned wavelength bands to an output port.

✓.

The optical filter of claim 1, wherein one of the first and second optical elements is tunable to change the corresponding first or second reflection wavelength, approximately align the first and second reflection wavelengths.

3. The optical filter of claim 1, wherein both of the first and second optical elements is tunable to change each of the respective first and second reflection wavelengths, approximately align the first and second reflection wavelengths.

9. The optical filter of claim 18, wherein one of the first and second filter functions comprises one of a Gaussian, rectangular and ramped profile.

12. The optical filter of claim 1, wherein at least one of the first and second tunable optical elements have an outer cladding and an inner core disposed therein, wherein the at least one of the first and second reflective element comprises a ~~first~~ grating disposed in a longitudinal direction of the inner core ~~of the first optical element, and the second reflective element comprises a second grating disposed in a longitudinal direction of the inner core of the second tunable optical element.~~

14. The optical filter of claim 12, wherein the at least one of the first and second optical elements is an optical waveguide having ~~has~~ an outer transverse dimension of at least 0.3 mm.

16. The optical filter of claim 23 further includes a ~~compressing compression~~ device that for compressing simultaneously and axially compresses ~~at least one of~~ the first and second tunable optical elements, wherein each of ~~at least one of~~ the respective first and second reflective elements is ~~are~~ disposed along an axial direction of the ~~each~~ respective first and second tunable element.

22. A tunable optical filter comprising:
a tunable optical element ~~waveguide~~ for receiving light, the optical element ~~waveguide~~ comprising:

a first reflective element for receiving light and reflecting a first wavelength band of the light centered at a first reflection wavelength, the first reflective element characterized by a first filter function; and

a second reflective element, optically connected to the first reflective element to receive the reflected first wavelength band of the light, for reflecting a second wavelength band of the light centered at a second reflection wavelength, the second reflective element characterized by a second filter function;

~~whereby the first reflection wavelength and the second reflection wavelength are approximately aligned to reflect a portion of the aligned wavelength bands to an output port.~~
whereby the first wavelength band and the second wavelength band overlap spectrally.

23. The optical filter in claim 22, wherein the tunable optical waveguide element ~~comprises an optical waveguide including~~ includes a cladding having a first and second inner core therein for propagating light, wherein the first reflective element ~~is~~ includes a grating disposed along an axial direction in the first inner core, and the second reflective element includes a grating ~~is~~ disposed along an axial direction in the second inner core.

24. The optical filter of claim 23, wherein tunable optical waveguide element has an outer transverse dimension of at least 0.3 mm.

25. The optical filter of claim 23, further comprising:
an optical directing device optically connected to the first and second inner cores; ~~tunable optical elements~~; the optical directing device directing the light to the first reflective element, directing the first wavelength band reflected from the first reflective element to the second reflective element, and directing the second wavelength band reflected from the second reflective element to the output port of the optical directing device.

27. The optical filter in claim 23 further includes at least a compressing device for axially compressing the tunable optical ~~element~~ waveguide to tune the first and second reflective elements.

31. The optical filter of claim 22 further includes:
a compressing device for axially compressing the tunable optical waveguide ~~element~~ to tune the first and second ~~gratings~~ reflective elements, responsive to a displacement signal, wherein the first and second ~~gratings~~ reflective elements are disposed axially along the tunable optical ~~element~~ waveguide; and
a displacement sensor, responsive to the compression of the tunable optical ~~element~~ waveguide, for providing the displacement signal indicative of the change in the displacement of the tunable optical waveguide ~~element~~.

32. A method for selectively filtering an optical wavelength band from an input light; the method comprising:

providing a first optical element including a first reflective element for receiving the input light and reflecting a first wavelength band of the light centered at a first reflection wavelength, the first reflective element characterized by a first filter function;

providing a second optical element, optically connected to the first optical element to receive the reflected first wavelength band of the light, including a second reflective element for reflecting a second wavelength band of light centered at a second reflection wavelength, ~~the second reflective element characterized by a second filter function being different than the first filter function; whereby the amplitude profile of the first filter function is different than the amplitude profile of the second filter function, and the first wavelength band and the second wavelength band overlap spectrally;~~ and

tuning one of the first and second reflective elements to ~~overlap spectrally the first reflection wavelength band and the second reflection wavelength band, align approximately the first reflection wavelength and the second reflection wavelength to reflect a portion of the aligned wavelength bands to an output port.~~

34. The method of claim 32, wherein the tuning one of the first and second reflective elements comprises:

substantially aligning ~~a~~the first reflection wavelength and ~~a~~the second reflection wavelength.

36. The method of claim 3234, wherein the tuning one of the first and second reflective elements comprises:

offsetting a first reflection wavelength and a second reflection wavelength by a predetermined spacing.

37. A compression-tuned optical filter comprising:

a first optical element including a first reflective element for receiving light and reflecting a first wavelength band of the light centered at a first reflection wavelength, the first reflective element characterized by a first filter function; and

a second optical element, optically connected to the first optical element to receive the reflected first wavelength band of the light, including a second reflective element for reflecting a second wavelength band of the light centered at a second reflection wavelength, wherein the amplitude profile of the first filter function is different than the amplitude profile of the second filter function, and the first wavelength band and the second wavelength band overlap spectrally.

~~whereby the first reflection wavelength and the second reflection wavelength are aligned to reflect a portion of the aligned wavelength bands to an output port;~~

wherein at least one of the first and second optical element has outer dimensions along perpendicular axial and transverse directions, the outer dimension being at least 0.3 mm along said transverse direction, at least a portion of the respective first or second tunable element having a transverse cross-section which is contiguous and comprises a substantially homogeneous material; and the respective first or second reflective element being axially strain compressed so as to change respective first or second reflection wavelength without buckling the respective first or second tunable element in the transverse direction.

38. The optical filter of claim 14, wherein said outer transverse dimension is greater than the dimension selected from the group consisting of 0.4 mm, 0.5 mm, 0.6 mm, 0.7 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm, 1.6 mm, 1.8 mm, 2.0 mm, 2.1 mm, 2.3 mm, 2.5 mm, 2.7 mm, 2.9 mm, 3.0 mm, 3.3 mm, 3.6 mm, 3.9 mm, 4.0 mm, 4.2 mm, 4.5 mm, 4.7 mm and 5.0 mm.

39. The optical filter of claim 29, wherein one of the first and second filter functions comprises one of a Gaussian, rectangular and ramped profile.

40. The optical filter of claim 29, wherein one of the first and second reflective elements is fully apodized and the other of the first and second reflective elements is partially apodized.

41. The optical filter of claim 24, wherein said outer transverse dimension is greater than the dimension selected from the group consisting of 0.4 mm, 0.5 mm, 0.6 mm, 0.7 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm, 1.6 mm, 1.8 mm, 2.0 mm, 2.1 mm, 2.3 mm, 2.5 mm, 2.7 mm, 2.9 mm, 3.0 mm, 3.3 mm, 3.6 mm, 3.9 mm, 4.0 mm, 4.2 mm, 4.5 mm, 4.7 mm and 5.0 mm.

42. The optical filter of claim 29, wherein the amplitude profile of the first filter function is different than the amplitude profile of the second filter function

43. The method of claim 32, further comprising tuning the other one of the first and second reflective elements to overlap spectrally the first reflection wavelength band and the second reflection wavelength band.

44. The method of claim 32, wherein one of the first and second filter functions comprises one of a Gaussian, rectangular and ramped profile.

45. The method of claim 32, wherein at least one of the first and second optical elements have an outer cladding and an inner core disposed therein, wherein the at least one of the first and second reflective element comprises a grating disposed in a longitudinal direction of the inner core.

46. The method of claim 45, wherein the at least one of the first and second optical elements is an optical waveguide having an outer transverse dimension of at least 0.3 mm.

47. The method of claim 45, wherein the at least one of the first and second optical elements is an optical fiber.

48. The method of claim 46, wherein said outer transverse dimension is greater than the dimension selected from the group consisting of 0.4 mm, 0.5 mm, 0.6 mm, 0.7 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm, 1.6 mm, 1.8 mm, 2.0 mm, 2.1 mm, 2.3 mm, 2.5 mm, 2.7 mm, 2.9 mm, 3.0 mm, 3.3 mm, 3.6 mm, 3.9 mm, 4.0 mm, 4.2 mm, 4.5 mm, 4.7 mm and 5.0 mm.

49. The optical filter of claim 37, wherein both of the first and second optical elements is tunable to change each of the respective first and second reflection wavelengths.

50. The optical filter of claim 37, wherein the first reflection wavelength and the second reflection wavelength are substantially aligned to reflect a portion of the aligned wavelength bands to an output port.

51. The optical filter of claim 37, wherein one of the first and second filter functions comprises one of a Gaussian, rectangular and ramped profile.

52. The optical filter of claim 37, wherein one of the first and second reflective elements is fully apodized and the other of the first and second reflective elements is partially apodized.

53. The optical filter of claim 37, wherein the first reflection wavelength is offset a predetermined spacing from the second reflection wavelength.

54. The optical filter of claim 37, wherein at least one of the first and second optical elements have an outer cladding and an inner core disposed therein, wherein the at least one of the first and second reflective element comprises a grating disposed in a longitudinal direction of the inner core.

55. The optical filter of claim 54, wherein the at least one of the first and second optical elements is an optical waveguide having an outer transverse dimension of at least 0.3 mm.

56. The optical filter of claim 37 further includes a compression device that axially compresses at least one of the first and second tunable optical elements, wherein at least one of the respective first and second reflective elements is disposed along an axial direction of the respective first and second tunable element.

57. The optical waveguide of claim 55, wherein said outer dimension of said waveguide in the transverse direction is greater than the dimension selected from the group consisting of 0.4 mm, 0.5 mm, 0.6 mm, 0.7 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm, 1.6 mm, 1.8 mm, 2.0 mm, 2.1 mm, 2.3 mm, 2.5 mm, 2.7 mm, 2.9 mm, 3.0 mm, 3.3 mm, 3.6 mm, 3.9 mm, 4.0 mm, 4.2 mm, 4.5 mm, 4.7 mm and 5.0 mm.

58. An optical filter comprising:

a first optical waveguide including a first reflective element for receiving light and reflecting a first wavelength band of the light centered at a first reflection wavelength, the first reflective element characterized by a first filter function; and

a second optical waveguide, optically connected to the first optical element to receive the reflected first wavelength band of the light, including a second reflective element for reflecting a second wavelength band of the light centered at a second reflection wavelength, the second reflective element characterized by a second filter function;

whereby the first reflection wavelength and the second reflection wavelength are substantially aligned to reflect a portion of the aligned wavelength bands.

59. The optical filter of claim 58, wherein one of the first and second optical waveguides is tunable to change the corresponding first or second reflection wavelength.

60. The optical filter of claim 58, wherein both of the first and second optical waveguides is tunable to change each of the respective first and second reflection wavelengths.

61. The optical filter of claim 58, further comprising:

an optical directing device optically coupled to the first and second optical waveguides; the optical directing device directing the light to the first reflective element, directing the first wavelength band reflected from the first reflective element to the second reflective element, and directing the second wavelength band reflected from the second reflective element to the output port of the optical directing device.

62. The optical filter of claim 58, wherein one of the first and second filter functions comprises one of a Gaussian, rectangular and ramped profile.

63. The optical filter of claim 58, wherein one of the first and second reflective elements is fully apodized and the other of the first and second reflective elements is partially apodized.

64. The optical filter of claim 58, wherein at least one of the first and second optical waveguides have an outer cladding and an inner core disposed therein, wherein the at least one of the first and second reflective element comprises a grating disposed in a longitudinal direction of the inner core.

65. The optical filter of claim 64, wherein the at least one of the first and second optical waveguides has an outer transverse dimension of at least 0.3 mm.

66. The optical filter of claim 64, wherein the at least one of the first and second optical waveguides is an optical fiber.

67. The optical filter of claim 59 further includes a compression device that axially compresses at least one of the first and second tunable optical waveguides, wherein at least one of the respective first and second reflective elements is disposed along an axial direction of the respective first and second tunable element.

68. The optical filter of claim 58, wherein the first and second reflective waveguides have different filter functions.

69. The optical filter of claim 58, wherein said outer dimension of said waveguide in the transverse direction is greater than the dimension selected from the group consisting of 0.4 mm, 0.5 mm, 0.6 mm, 0.7 mm, 0.8 mm, 1.0 mm, 1.2 mm, 1.4 mm, 1.6 mm, 1.8 mm, 2.0 mm, 2.1 mm, 2.3 mm, 2.5 mm, 2.7 mm, 2.9 mm, 3.0 mm, 3.3 mm, 3.6 mm, 3.9 mm, 4.0 mm, 4.2 mm, 4.5 mm, 4.7 mm and 5.0 mm.